Exercise 1, page 211

Use the northwest-corner method to generate a basic feasible solution for the transportation models given below. The rows correspond to suppliers and the columns correspond to demand centers. The last row shows the demand values \( d_j \) for each demand center, while the last column indicates the available supply \( b_i \) for each supply center.

(a)  
\[
\begin{array}{ccc|c}
0 & 2 & 1 & 6 \\
2 & 1 & 5 & 7 \\
2 & 4 & 3 & 7 \\
\hline
5 & 5 & 10 & \\
\end{array}
\]

(b)  
\[
\begin{array}{ccc|c}
1 & 2 & 6 & 7 \\
0 & 4 & 2 & 12 \\
3 & 1 & 5 & 11 \\
\hline
10 & 10 & 10 & \\
\end{array}
\]

(c)  
\[
\begin{array}{ccc|c}
5 & 1 & 8 & 12 \\
2 & 4 & 0 & 14 \\
3 & 6 & 7 & 4 \\
\hline
9 & 10 & 11 & \\
\end{array}
\]

Solve the problem in Exercise 5, page 198, which is the second problem of Homework 6 assignment (MG Auto).

Solve the problem in Exercise 8(b), page 198, which is the third problem of Homework 6 assignment (refineries).

Exercise 5, page 219

In a \( 3 \times 3 \) transportation problem, let \( x_{ij} \) be the amount shipped from source \( i \) to destination \( j \), and let \( c_{ij} \) be the corresponding transportation cost per unit of shipment. The amounts of supply at sources 1, 2, and 3 are 15, 30, and 85 units, respectively. The demands at destinations 1, 2, and 3 are 20, 30 and 80, respectively. Assume that the northwest-corner solution is optimal, and the associated multiplier values (shadow prices) are given by

\[
\begin{align*}
\mathbf{u} &= -2, \\
\mathbf{v} &= 2, \\
\end{align*}
\]

\( u_1 = -2, \quad u_2 = 3, \quad u_3 = 5 \)

\( v_1 = 2, \quad v_2 = 5, \quad v_3 = 10. \)

(a) Find the associated optimal cost.

(b) Determine the smallest value of \( c_{ij} \) for each nonbasic variable that will maintain the optimality of the northwest-corner solution.